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ASIAN REVIEW

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THE NEW
IRON CURTAINChinese and US technology industries
brace for a digitally divided world

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SEPARATION ANXIETY

YASU OTA Nikkei Asian Review columnist

A tariff spat is rapidly transforming
into a technology cold war.
But can anybody win?

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WE MUST
ALWAYS
BE THE
LEADER IN
EVERYTHING
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ESPECIALLY
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WORLD OF
TECHNOLOGY

“

WE ARE
NOW
EMBARKING
ON A NEW
LONG
MARCH,
AND WE
MUST
START
ALL OVER
AGAIN

U.S. President Donald Trump

Chinese President Xi Jinping

GUIYANG, China/TOKYO/HONG KONG/PALO ALTO, U.S.

The mountainous region of Guizhou has long been the poorest of China's 31 provinces, known mostly for producing a few herbs used in traditional Chinese medicine, and *maotai*, a popular distilled Chinese liquor. Its gross domestic product per capita was \$6,233 in 2018, less than one-third of Beijing's.

But Guiyang, the provincial capital city of 4.6 million people, has grand ambitions to transform itself into China's newest digital hub. Its goal is neatly summed up by a three-character Chinese word, *dashuju*, or "big data," and residents are unlikely to forget it. *Dashuju* is plastered all over the city: There is the "Plaza of *Dashuju*," the "Human Resource Center for *Dashuju*," "*Dashuju* Park" and even "*Dashuju* Apartments."

Guiyang's leaders are hoping that this focus on big data -- the backbone of next-generation 5G mobile and cloud computing services -- will make the city a stronghold for Beijing's Digital Silk Road strategy. And while its remote geography has been one of the reasons it has remained so poor for so long, it offers some distinct advantages in the data business. The ample water resources nearby will provide plenty of cheap hydropower to run giant computer servers, while the mountainous region's steady climate will help keep them cool.

"The biggest data centers in China are being built in the area by giants in the digital industry," said Li Haibo, director of the International Cooperation Promotion Center of Guiyang High-Tech Industrial Zone. Two of the world's leading tech companies, **Tencent Holdings** and Apple, are among them.

Apple broke ground on a \$1 billion data center in Guiyang in May 2018, with the project expected to be completed next year. The U.S. tech company plans to combine its iCloud computing service with the one operated by the provincial government, allowing it to provide storage services to China's enormous market of 1.4 billion people. Apple plans to eventually expand its offering to nations participating in China's Belt and Road Initiative, according to Li, who is overseeing Guiyang's data center push.

America's big tech exposure

S&P 500 companies ranked by share of revenue from China (in percent)

1	Qualcomm	64.7
2	Micron Technology	57.2
3	Qorvo	55.0
4	Broadcom	48.0
5	Texas Instruments	43.1
14	Intel	25.9
17	Nvidia	23.2

Figures based on latest fiscal year results; where country-level data unavailable, revenue calculated using a proprietary FactSet algorithm Source: FactSet



Getty Images

Asked about the city's digital ambitions, Li demurred. "We, government officials, cannot talk about the dream; we can only talk about [how to] plan and execute it."

But Guiyang's dream -- and Apple's business opportunity -- represent the sort of U.S.-China technological partnership that has thrived for years, and which now faces an almost existential threat. What began as a tariff spat between the U.S. and China now appears to be morphing into a nationalistic battle for techno-

logical supremacy, one that some say could draw a "digital iron curtain" between Apple and its Guiyang operations.

As chairman of Taiwan's **Hon Hai Precision Industry** -- better known as Foxconn Technology Group -- Terry Gou has played a major role in the intertwining of the U.S. tech industry and manufacturing in mainland China. His company has been the biggest production partner for Apple's iPhone, but now he sees the trade war unwinding these close ties.

"In the future, there will be no G-20, but only G-2 -- the U.S. and China," said Gou.

"The world will have to live with the two [technology] standards, created by the U.S. and China separately after the two big powers' fierce competition. ... It's likely that it will become 'One

"EVEN IF THE U.S. WANTS TO BUY OUR PRODUCTS, I MAY NOT SELL TO THEM"

Ren Zhengfei Huawei CEO



"HUAWEI IS VERY DANGEROUS"

U.S. President Donald Trump



World, Two Systems."

Such dire predictions have stemmed from the U.S. decision under President Donald Trump to ban American companies from doing business with Huawei Technologies, citing a threat to U.S. national security. If the ban holds, it effectively starves one of China's technological success stories from components that are essential to its business. On June 17, Huawei said it had slashed its sales expectations for the next two years by \$30

Huawei tops world 5G patent ownership

Key owners of standard essential patents (by number of patent families)

Huawei Technologies (China)	1,554
Nokia* (Finland)	1,427
Samsung (South Korea)	1,316
LG Electronics (South Korea)	1,274
ZTE (China)	1,208
Qualcomm (U.S.)	846
Ericsson (Sweden)	819
Intel (U.S.)	551
China Academy of Telecommunications Technology (China)	545
Sharp (Japan)	468
Oppo (China)	207
Apple (U.S.)	12
BlackBerry (Canada)	9
Other	121

As of April 2019
Covers top 27 companies
owning 5G standard
essential patents
*Including Alcatel-Lucent

Source: IPlytics

billion due to the Trump ban (see related story on page 26). Chinese President Xi Jinping has compared the tech conflict with the U.S. to the Red Army's "Long March" under Mao in the 1930s -- which many observers say indicates that the country is girding for a prolonged battle.

"Even if the Chinese tech industry is not ready, we will have no choice but to take the 'new Long March,'" said Wang Huiyao, president of the Center for China and Globalization, an independent think tank in Beijing. "The Chinese tech industry is at a critical moment and we can't just sit and watch it die. We used to rely on global suppliers, letting other countries do what they can do the best. Now, we will have to build our own supply chain."

BIPOLAR WORLD Huawei has roots in Guizhou. The company's founder, Ren Zhengfei, migrated from Guizhou to Shenzhen, Guangdong Province, and set up Huawei there in 1987. For him, the tech war has become a personal matter: Meng Wanzhou, Ren's daughter and Huawei's chief financial officer, was arrested in Canada last December as part of a probe related to alleged attempts by Huawei to sell U.S.-made equipment to Iran in violation of sanctions.

The U.S. claims -- without providing much evidence publicly -- that the use of Huawei smartphones and telecommunications equipment results in the leakage of information to the Chinese government. Chances of such espionage risk will increase if Huawei, which is leading American and European companies in

the rollout of 5G mobile communications technology, monopolizes the global telecom infrastructure, the U.S. argues.

China's internet security and national security laws make it mandatory for businesses to submit information to the government when deemed necessary. Ren said in an interview with the Nikkei Asian Review in January that he would refuse to submit information even if requested by the government. In reality, however, he simply cannot.

Trump's attacks on Huawei fit with his "America First" campaign theme, and his broader accusations that China has been "ripping off" the U.S. for decades. But U.S. suspicion of Huawei predates the Trump administration: In 2008, the U.S. blocked Huawei's attempt to buy a stake in U.S. rival 3Com on security grounds.

The U.S. administration's bashing of China has also proved popular with American lawmakers and citizens, whether they are Republicans or Democrats. And, though there is support for the Trump administration's attempts to enforce intellectual property rights in China, U.S. businesses -- especially in the tech industry -- worry about the administration's barefisted approach.

To counter the U.S. moves on Huawei, Xi has suggested imposing restrictions on exports of rare-earth elements, which are indispensable for American high-technology companies, and announced a plan to ban the overseas transfer of advanced technologies from China.

The uncertainty is already having an effect on high-tech com-

"IN THE FUTURE, THERE WILL BE NO G-20, BUT ONLY G-2: THE U.S. AND CHINA. ... IT'S LIKELY THAT IT WILL BECOME 'ONE WORLD, TWO SYSTEMS'"

Terry Gou Chairman of Foxconn

Foxconn Chairman Terry Gou, center, has played a major role in linking the U.S. tech industry and manufacturers in mainland China.



panies on both sides of the Pacific. "Many of my clients -- especially the ones in Huawei's supply chain, or companies in the business of high-tech -- are postponing their plans to expand to the U.S., or cutting budgets," said one business consultant based on the U.S. West Coast.

Trump's executive order has disabled Huawei from gaining access to updates of Google's Android mobile operating system, and from procuring parts made by Qualcomm, the market leader for telecom modem chips. Mobile carriers in Japan have complied with the Trump administration's requests by halting the procurement of telecom equipment from Huawei and postponing sales of its new P30 series smartphones. Australia and New Zealand have also halted the government procurement of equipment from Huawei.

Against an increasingly tense backdrop, Trump and Xi agreed in an emergency telephone conversation on June 18 to meet face-to-face on the sidelines of the Group of 20 summit, to be held in Osaka in late June. In the run-up, discussion is rising as to whether a technology "cold war" will result in a bipolar world: one where separate digital policies and standards will divide the Chinese and U.S. spheres of influence.

Lu Fang-Ming, chairman of Asia Pacific Telecom, Foxconn's telecom unit, said previous generations of mobile technology were built along a variety of standards, but 5G is different. If the China-U.S. tensions reversed that, it would be a setback for the industry, he said.

"5G is the very first time that, so far, the world agreed to only one [mobile technology] standard, but we don't know whether that will change after all these tensions. ... I personally believe open sources and a common standard really help

technology development and new adoptions [to occur] more quickly," said Lu.

VALUE OVER POLITICS The fear is that a tech cold war, splitting the world into China- and U.S.-led spheres, could end the benefits that have come from having global standards for components. But it is far from clear how these divisions would be drawn. For a start, the attitudes of Asian nations located in the area covered by China's Belt and Road are not as predictable as Washington may have expected.

"Huawei's research is far bigger than Malaysia's capability. We try to make use of their technology as much as possible," Malaysian Prime Minister Mahathir Mohamad said in his address to the annual Future of Asia conference hosted by Nikkei in Tokyo in late May.

Pichet Durongkaveroj, Thailand's minister of digital economy and society, told the conference that the country would not join the camp

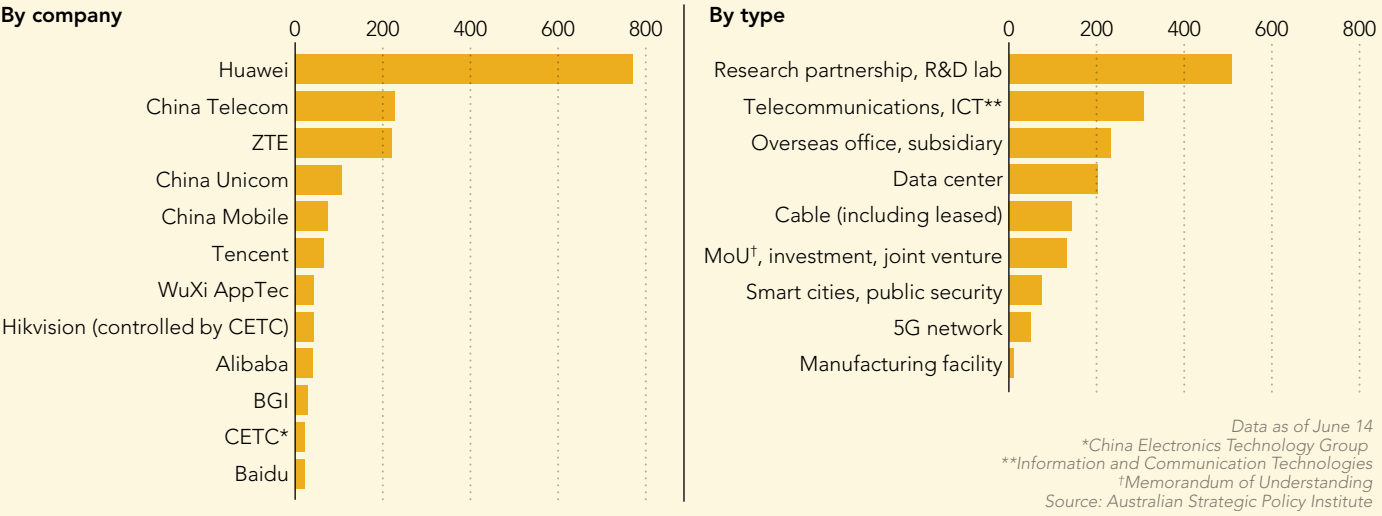
to exclude Huawei, saying, "Bangkok is friendly to players of all countries."

Other Southeast Asian countries are also unlikely to side with the U.S. in shutting out Huawei. Even South Korea, an ally of the U.S., has not clarified its stance, possibly because of pressure from China. Asia, therefore, is not as clear-cut as the U.S. may have thought.

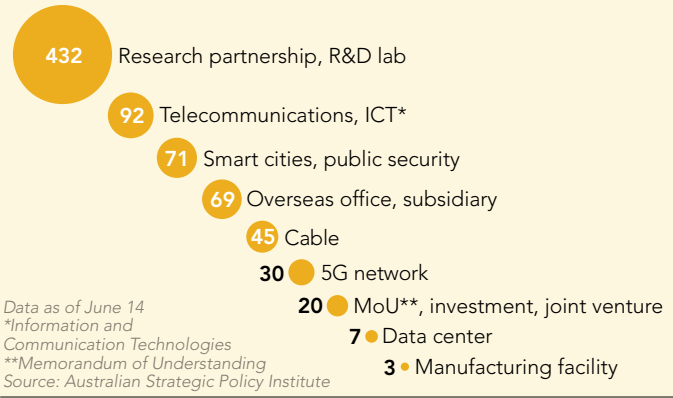
One thing is clear, however: In areas where Huawei is already used, telecom infrastructure costs are lower than where it is not. In the 5G market, Huawei leads its rivals Ericsson and Nokia in price and technological competitiveness, and is set apart by its aggressive management style.

Some countries are "fine with potential security issues, if the price is right," says Jeffrey Towson, a private equity investor and

China's big tech exposure (number of international projects of 12 major companies)



Huawei’s overseas reach (international projects, by type)



Getty Images

professor of investment at Peking University in Beijing. “They are more interested in getting a modern telco network at a great price. In these nonsensitive markets, Huawei should be very successful.”

DIGGING IN IN SHENZHEN The mood in Shenzhen, known as “China’s Silicon Valley,” has changed dramatically since May. “Shenzhenians have been strengthening a sense of unity and emotion of nationalism, feeling that Shenzhen is being attacked by the U.S.,” said an information technology consultant, who frequently shuttles between the city and Tokyo, on condition of anonymity.

Some in the West have held out in the belief that the trade pressure can change China’s political, economic and industrial structure. The reverse may, in fact, be true. Pressure from the U.S. “is the driving power uniting Chinese tech companies to reinvent the wheel and break free from ... [Google’s] Android, Qualcomm or Intel,” said a venture capitalist based in Shenzhen.

Unlike **ZTE**, which was driven to the brink of collapse due to a U.S.-imposed trade ban, Huawei has its own semiconductor subsidiary, HiSilicon. Huawei is likely to be able to develop its own operating system, one that would look like Android.

Beijing’s “Made in China 2025” initiative was launched to reduce its dependence on foreign suppliers of semiconductors and other key technologies. But Paul Triolo, head of geotechnology research at U.S.-based research firm Eurasia Group, is skeptical about China’s ability to achieve technological independence. China, he says, “will remain heavily dependent on U.S., Japanese, and European suppliers, and on Taiwan for the fabrication of cutting-edge chips,” he said.

The belief in Beijing that the U.S is lowering a “digital iron curtain” between the two countries is prompting an even more intense focus on becoming self-sufficient, Triolo notes. But he says it is “simply not possible for China to completely disengage” from global supply chains.

“The reality is that no country can become self-sufficient in the technologies needed to maintain and develop a modern

^
Meng Wanzhou, Huawei’s chief financial officer and daughter of the company’s founder, leaves court following a hearing in Vancouver in May.

technology-based economy,” he said. Some of China’s main tech partners in the region are standing with it, at least for now. **Taiwan Semiconductor Manufacturing Co.**, the world’s largest foundry, announced in May that it will continue shipments to Huawei, saying that it has concluded it won’t breach the export ban as long as U.S.-derived technology accounts for less than 25% of the product value. South Korea’s **SK Hynix** and Sony of Japan apparently intend to keep supplying semiconductors. Containing China in the digital sector, where supply chains have diversified, appears far more difficult than banning Iranian oil imports.

Back in Guiyang, Apple has little choice for now but to continue work on its data center project according to rules set before Trump’s tech war. This includes complying with China’s law that foreign companies, like Apple, must partner with local Chinese companies to build the facilities they need to host data in the country.

But Apple can also feel confident that, should China halt the data center joint venture as retaliation for Trump’s attacks, it would likely hurt the Chinese partners more than Apple. This dynamic may well be what heads off a tech cold war, notes the strategy consultant working with tech companies on both sides of the Pacific.

“Trump needs a trade deal more than Xi does. So, if there is going to be a tech cold war, it might be more likely to be initiated from the China side,” he noted. “But, given China still has a long way to go in terms of competing with the U.S. in technology development, I don’t think that would be a logical move.” **N**

Nikkei staff writers Cheng Ting-Fang and Lauly Li in Taipei, Coco Liu in Hong Kong and Yifan Yu in Palo Alto contributed to this report.

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to India and China for growth

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NIKKEI ASIAN REVIEW

Sept. 16-22, 2019

WAR FOOTING

Inside Huawei's secret plan
to beat American sanctions



U.S.: US\$6 / Japan: ¥600 (including tax) / Euro: EUR6 / U.K.: £4 / Australia: A\$8 / Bangladesh: TK480 / Brunei: B\$9 / Cambodia: US\$6 / Canada: C\$9 / China: RMB50 / Hong Kong: HK\$50 / India: Rs200 / Indonesia: Rp72000 / Korea: ₩7500 / Macau: HK\$50 / Malaysia: RM20 / Mongolia: US\$6 / Myanmar: US\$6 / Nepal: NR470 / New Zealand: NZ\$9 / Pakistan: Rs600 / Philippines: P280 / Singapore: S\$9 / Sri Lanka: Rs800 / Switzerland: CHF10 / Taiwan: NT\$200 / Thailand: B210 / Turkey: TL16 / UAE: AED27 / Vietnam: US\$6
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華為

HUA WEI

trans. "CHINA CAN MAKE IT"

Huawei is quietly ramping up orders from Asian suppliers -- and leading a wave of de-Americanization in Chinese technology

CHENG TING-FANG and LAULY LI Nikkei staff writers

An engineer stands under a 5G base station antenna testing system at Huawei's Songshan Lake Manufacturing Center in Dongguan, China.

SHENZHEN/SHANGHAI/TAIPEI In the first few weeks of 2019, 20 engineers from Huawei Technologies arrived in the riverside town of Jiangyin in eastern China on a secret mission. They took up stations at the state-backed Jiangsu Changjiang Electronics Technology, China's largest chip packaging and testing company, where they went to work upgrading the facilities and increasing the site's capacity, ahead of a production surge in the autumn.

"These Huawei staff are on-site almost seven days a week, from day to night, nitpicking and reviewing all the details ... demanding strictly that the local company meets global standards as soon as possible," one chip industry executive familiar with the situation told the Nikkei Asian Review. "It's honestly like preparing for wartime."

All across Asia, companies in the computer chip industry were receiving similar messages from Huawei: Boost your production, and we will buy your product. In a slowing global market, Huawei made a commitment that was impossible to resist: The company guaranteed up to 80% utilization rates for the next two years to potential and current suppliers.

Spooked by the arrest in December 2018 of its chief financial officer, Meng Wanzhou -- daughter of the company's founder and CEO, Ren Zhengfei -- and anticipating an escalation from the White House, Huawei activated a plan to decouple itself from its U.S. suppliers by pushing fellow Asian companies to speed up and scale up.

By May, when the U.S. announced strict new limits that all but prevented American companies from selling technology to Huawei, the Chinese telecom giant was already on a war footing. Others in China have followed its lead, preparing to move wholesale away from their reliance on U.S. technology in what could become a permanent "de-Americanization" of the Chinese tech industry.

"We see a clear trend of Chinese companies decoupling from U.S. suppliers," said Scott Lin, senior vice president of WPG Holdings, the world's biggest semiconductor distributor. "After all, no one wants to be suddenly cut off from supplies."

Now that these plans are in motion, Lin said, "there is no turning back."

WARNING SIGNS Ren, a former engineer from China's People's Liberation Army, founded Huawei in the southern industrial city of Shenzhen in 1987. From its roots as a tiny manufacturer of networking switches, the company has grown to become a global leader in telecom and a national champion in China. Huawei is now the world's largest supplier of telecom equipment, with operations in 170 countries. In 2018, it overtook Apple to become the world's second-biggest smartphones manufacturer. It now employs 194,000 staff, with annual revenues of more than \$105 billion -- comparable with Google's parent company, Alphabet.

That size makes it a huge market for suppliers of components and software. Huawei's annual procurement budget is around \$70 billion. The company spends \$15 billion every year on semiconductors alone; only Apple and Samsung Electronics spend more. In 2018, it bought more than 200 million displays and hundreds of millions of camera lenses.

A lot of those components come from the U.S. In 2018, Huawei procured \$11 billion worth of goods from American suppliers. Qualcomm, Intel and Texas Instruments supply Huawei with various types of

“It’s honestly like preparing for wartime

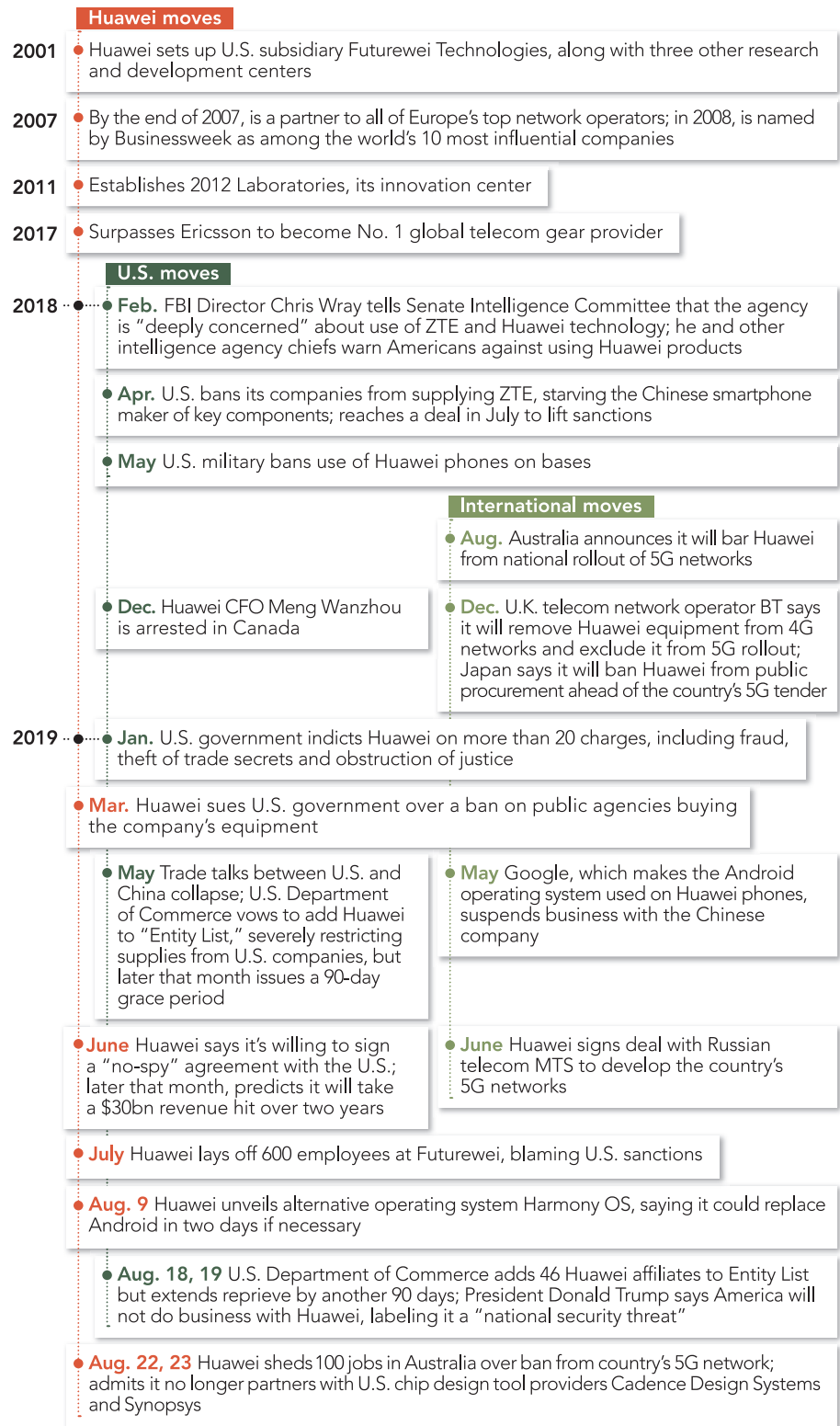
A chip industry executive

on Huawei's production surge plans at supplier Changjiang Electronics Technology



ON THE COVER

Hot and cold: Huawei's efforts to go global



▲ Huawei Chief Financial Officer Meng Wanzhou, arrested in December 2018, leaves her family home flanked by private security in Vancouver on May 8.

chips; Skyworks Solutions and Qorvo provide high-end radio frequency technology; Synopsys and Cadence Design Systems provide chip-design tools; Google and Microsoft supply software. Further down the supply chain, chemical companies such as Applied Materials, Corning, 3M and Dow Chemical sell their products into other enterprises that help Huawei to develop advanced panels and build semiconductors.

Huawei's scale, and its links to the Chinese state, have long been a cause for concern in the U.S. The company has had three bids for American tech companies blocked by U.S. authorities on national security grounds -- 3Com in 2008, Motorola's wireless infrastructure unit in 2010, and 3Leaf Systems in 2011. In 2012, a report by the U.S. House Intelligence Committee alleged that Huawei was spying on American enterprises in an attempt to gain access to advanced technology. The company has consistently denied the allegations.

Things escalated after U.S. President Donald Trump took office. In January 2018, the largest carrier in the U.S., AT&T, dropped plans to sell Huawei's flagship Mate 10 smartphone, following public

statements by American lawmakers and intelligence agencies alleging that the Chinese company presented an espionage risk. Later that year, the government barred any public institutions, including the military, from using Chinese-made equipment.

In May this year, the White House moved to cut Huawei off from its American suppliers. Huawei was put on the U.S. Department of Commerce's "Entity List," blacklisting it for U.S. companies. Qualcomm, Micron Technology, Texas Instruments, Qorvo, Lumentum Holdings, Synopsys and Cadence Design Systems, as well as Google -- whose Android operating system Huawei uses -- all confirmed that they would have to stop working with Huawei. Some later resumed limited shipments. In August, the Department of Commerce added a further 46 Huawei affiliates, including more than 10 key research facilities, to the blacklist. The sanctions were designed to cripple Huawei's ability to compete and to innovate.

"Huawei is at the center of the U.S.-China tech cold war primarily because of concern over the firm's dominance, globally, of next-generation wireless technology," said Paul Triolo, the head of geotechnology research at consultancy Eurasia Group.

If the plan was to slow Huawei's technical progress, it may have backfired. Instead, it appears to be accelerating China's desire to develop homegrown alternatives to American technology.

Huawei had anticipated the Americans' game plan. In March 2016, the U.S. government put ZTE, another Chinese telecom company, on the Entity List, after it

was found to have sold equipment to Iran in defiance of sanctions. ZTE had been under investigation since 2012, but the escalation spurred Huawei to formulate a concrete contingency plan, sources told Nikkei. As soon as Meng was arrested in Canada, the company began to stockpile key components and to qualify new suppliers.

DE-AMERICANIZATION For years, RichWave, a little-known Taiwanese maker of Wi-Fi front-end modules -- an important piece of communications technology within smartphones and other devices -- has been trying to engage with Huawei. RichWave competes with far larger American rivals, such as Skyworks, Qorvo and Broadcom, all of which have successfully negotiated their way into Huawei's supply chain. RichWave, though, just could not get certified as a supplier.

This summer, the company suddenly got the green light from Huawei. It began shipping products in August.

"Our relationships with this Chinese client just skipped the traditional business engagement process and jumped to direct replacement [of other suppliers]," said Kick Huang, RichWave's general manager for China. "And we are not the only

Source: IHS Markit, IDC, Digitimes Research

Globally,
Huawei is
NO. 1
in telecom gear sales

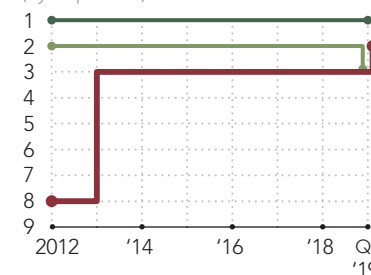
NO. 2
in smartphone shipments

NO. 5
in chip design, servers
and storage hardware

The rise and rise of Huawei

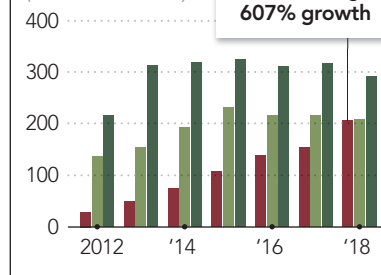
● Huawei
● Apple
● Samsung

Ranking by market share (by shipments)

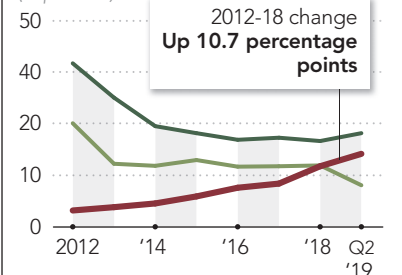


Source: IDC

Annual shipments (in millions of units)



Market share by shipments (in percent)



beneficiary in this trade war.”

Huawei’s outreach to Chinese and other Asian suppliers has been far-reaching. Nikkei has learned that alongside Jiangsu Changjiang Electronics Technology, other leading chip assembly and testing providers, including ASE Technology Holding, Siliconware Precision Industries, Powertech Technology and King Yuan Electronics all received the nod from Huawei to expand their production inside China, as did printed circuit board makers Unimicron Technology.

Taiwan Semiconductor Manufacturing Co., the world’s biggest contract chip-maker, has been asked by Huawei to put new customized chips into production

with the aim of replacing chips from Intel and Xilinx, sources familiar with the matter said. Win Semiconductors, a contract manufacturer of power amplifiers, optical parts and radio frequency components, has

received increased orders from HiSilicon Technologies, Huawei’s chip design arm. MediaTek, the world’s second-largest mobile chipmaker after Qualcomm, and Japan’s Murata Manufacturing have also gained orders, multiple industry sources confirmed.

FIH Mobile -- a subsidiary of Hon Hai Precision Industry, commonly referred to as Foxconn -- and BYD, a Chinese manufacturer, have won new contracts to assemble Huawei smartphones. Huawei’s previous major manufacturer, U.S.-based Flex, suspended some shipments after the American ban came into effect.

Some suppliers confirmed that Huawei has also been secretly preparing its own technologies for years, but has not put them into large-scale use. The company has been trialing its own radio frequency components for a decade, one tech exec-

utive with direct knowledge of the trials told Nikkei. The Chinese company began to put several of those designs into mass production in the spring of 2019.

“It’s not like most outsiders think -- [that] Huawei only started to develop those crucial RF parts after the supply was cut off,” the executive said. “The quality and performance may not be 100% as good as [U.S. supplier] Skyworks; but it is workable, and maybe users won’t feel a big difference.”

Many second- and third-tier suppliers, who previously would have had no chance to enter Huawei’s supply chain, have now been handed a once-in-a-lifetime opportunity to move up the ladder, Roger Sheng, a veteran tech analyst at consultancy Gartner in Shanghai, said. The shift away from American manufacturers may outlast the trade war, he added: “Even if the U.S. later allows Huawei to use American components, it’s never going to go back to the old days, like nothing had happened.”

Moves toward “de-Americanization”

“We see a clear trend of Chinese companies decoupling from U.S. suppliers. ... There is no turning back

Scott Lin

Senior vice president of WPG Holdings, the world’s biggest semiconductor distributor

Ramping up

Key chip manufacturers asked by Huawei to increase production

	Companies	Description
China	Semiconductor Manufacturing International Co.	Gained orders for Huawei-designed mid- to low-end chips
	Jiangsu Changjiang Electronics Technology	China’s biggest chip packaging and testing house
Taiwan	Taiwan Semiconductor Manufacturing Co.	Huawei has stepped up orders as it puts more self-designed, customized chips into production following U.S. ban
	Win Semiconductors	Gained orders for Huawei-designed radio frequency chips; a contract manufacturer for Skyworks Solutions and Qorvo
	ASE Technology Holding	World’s biggest chip packaging, assembly and testing service provider
	Siliconware Precision Industries	Acquired by ASE
	Powertech Technology	World’s biggest memory chip packaging and testing service provider
	King Yuan Electronics	Major chip testing service provider

Source: Industry sources, Nikkei Asian Review analysis

are spreading. This year, Xiaomi, another leading smartphone supplier, has invested in several local chip-related companies, including Bluetooth and audio chip startup Bestechnic, and design service provider VeriSilicon Holdings. Alibaba Group Holding also unveiled its own artificial intelligence chip platform, based on open-source technology, in July.

“Huawei is the most obvious and aggressive case,” WPG’s Lin said. “But it is not the exception.”

REAL IMPACT Even as prepared as it was, Huawei has been hurt by the U.S. attacks on its supply chain and its customer base. The U.S. has been lobbying its allies to try to restrict Huawei’s markets, and the constant negative news flow has inevitably cast a



Illustration by Eric Chow

Up to
80%
Utilization rate*
promised by Huawei
to secure suppliers
*Over the next two years
Source: Industry sources

Huawei P30 Pro:
sum of its parts

U.S. component makers have supplied critical parts for Huawei phones. Here’s how that’s begun to change

OPERATING SYSTEM

Google Android (U.S.) Supports Gmail, YouTube, etc.; Huawei’s proprietary Harmony OS has been developed to replace Android, but a near-term rollout appears challenging

CAMERA-RELATED PARTS

LENSES
Largan Precision (Taiwan) Also a key Apple supplier
Kantatsu (Japan) Owned by Foxconn-controlled Sharp
Sunny Optical (China) China’s biggest smartphone-lens maker
CMOS IMAGE SENSORS
Sony (Japan)
CAMERA DESIGN
Leica (Germany)
OPTICAL COMPONENTS FOR 3D SENSING
Lumentum (U.S.) Halted shipments to Huawei; unclear if resumed

NAND FLASH MEMORY CHIPS

Samsung Electronics (South Korea) World’s biggest NAND flash memory maker
SK Hynix (South Korea)
Toshiba (Japan) No. 2 NAND maker
Micron (U.S.) Halted shipments to Huawei following U.S. ban; has partly resumed (potential replacement)
Tsinghua Unigroup’s Yangtze Memory Technologies (China) Yet to mass-produce, but Yangtze is China’s hope to take on Samsung and Micron in the global NAND market

AUDIO CHIPS

Huawei’s HiSilicon Technologies (China)

DRAM CHIPS

Samsung Electronics (South Korea)
SK Hynix (South Korea)
Micron (U.S.) (potential replacements)
Changxin Memory Technologies (China) China doesn’t yet produce high-end mobile DRAM; is keen to develop its own
Tsinghua Unigroup (China)

MOBILE PROCESSORS (beneath DRAM chip)

Huawei’s HiSilicon Technologies (design) (China) Chip architecture based on tech from SoftBank-controlled Arm Holdings (U.K.), which reportedly stopped working with Huawei in May; manufactured by Taiwan’s TSMC, sole manufacturer of Huawei high-end processors (as well as iPhone core processors)

COVER GLASS, GLASS BACKING, METAL FRAMES

Corning (U.S.) Lost supply share to Lens Technology
Lens Technology (China) Key supplier of screen glass to Samsung and Apple
BYD (China) Also longtime assembler of Huawei phones

DISPLAY-RELATED PARTS

OLED PANELS
BOE Technology (China)
LG Electronics (South Korea)
TOUCH MODULE
O-Film Tech (China)
FINGERPRINT CHIP
Goodix (China)

ASSEMBLY

Flex (U.S.) Suspended shipments in May; was accused by Huawei of detaining assets
FIH Mobile (Taiwan) Subsidiary of Foxconn; among assemblers gaining market share at Flex’s expense
BYD (China) Also gained market share from Flex
Wingtech Technology (China)

AUDIO PARTS, INCLUDING MICROPHONES, SPEAKERS

AAC Technologies (China)
GoerTek (China)
Merry Electronics (Taiwan)

BATTERY PACKS

Desay Battery (China)
Sunwoda (China)
Amperex Technology (TDK) (Hong Kong)

WIRELESS CHARGING

Luxshare-ICT (China) Also makes Apple’s cables and AirPods
Shenzhen Sunway Communication (China) Another Apple supplier

COMMUNICATION AND RADIO FREQUENCY CHIPS

Huawei’s HiSilicon Technologies radio frequency transceiver (China)
Skyworks Solutions front-end module (U.S.) With Skyworks and Qorvo temporarily halting supply, Japan’s Murata Manufacturing gained orders; newcomers like RichWave (Taiwan) quickly gained supply certification
Qorvo front-end module (U.S.)

OTHER CHIPS

Qualcomm (U.S.) Major mobile chip manufacturer has halted shipments to Huawei since May; unclear if resumed
MediaTek (Taiwan) Qualcomm rival; has gained share

Source: iFixit (www.ifixit.com), Bernstein Research, Goldman Sachs, Nikkei Asian Review analysis

pall over its performance. Ren has said he expects the company’s revenue to fall by \$30 billion this year. It has had to retreat from the American market almost entirely, while European market smartphone shipments fell by 16% in the second quarter, according to research company Canalys.

Despite the hits to its overseas sales, Huawei has proved surprisingly resilient, said Arisa Liu, an analyst at the Taiwan Institute of Economic Research. “But Washington could still come up with new ways and tighter controls. If it’s a prolonged [clampdown], some Huawei projects will still be delayed and its tech development will be slowed. But ... it’s not dying or crashing.”

Perhaps the biggest question hanging over the company is over the software that it uses on its phones. Google’s Android operating system has an 80% share of the global smartphone market, and is used by Samsung Electronics, Xiaomi, Oppo and

LG Electronics. That huge user base has translated into a massive ecosystem of mobile apps, and the services that Google offers alongside it -- Google Play, Gmail, YouTube and Google Maps -- are a major draw for users.

Without a permit from the U.S. government, Huawei’s new smartphones launched after the ban may not have access to Google’s mobile services.

In August, Huawei introduced its own “Harmony” operating system. Although Huawei said it will prioritize using Android on its phones if allowed to do so, it claims it is very simple for mobile app developers to build apps on

its new OS, and that it would “only take one to two days” to migrate Android to Harmony if needed.

Harmony was initially slated to roll out on smart televisions, watches and speakers, not on handsets -- a fact that market watchers said shows that the process of replacing Android might not be so simple. At the recent IFA 2019 electronics expo in Berlin, though, Huawei’s consumer business head Richard Yu told Chinese media that it may introduce the Harmony smartphone version with the flagship P40, due to be announced next March.

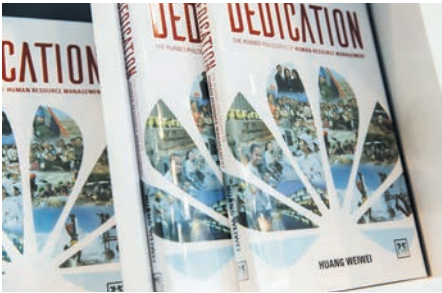
Huawei has acknowledged that it needs an ecosystem of services to get Harmony off the ground, and has said it will invest \$1 billion to support developers to build apps on its platform.

Privately, some Huawei employees acknowledge how sizable the task is. “We have fully prepared for some tough times if we need to use our own operating system,” one manager told Nikkei. “An OS really needs massive [numbers of] users and accumulated time for feedback and debugs so that it can run smoothly. We believe all the Chinese developers will be on our side, but it will still take some one to two years for the ecosystem to thrive.”

Domestic consumers might be patient, but losing access to Google’s services could have a real impact on Huawei’s international smartphone ambitions. “Without Android and those popular apps, it’s likely that Huawei would be forced to become only ‘China’s Huawei’ instead of the more powerful ‘global Huawei’ that it is currently,” a tech executive told Nikkei.

NATIONAL PRIDE One undeniable factor behind Huawei’s resilience is the support that it has received from Beijing. The company’s name means “China can make it,” and there is a sense that protecting the company from foreign aggression has become a national project.

In the face of the trade war, Chinese consumers are buying local. Huawei’s share of the domestic smartphone market advanced to a re-



Getty Images

^
Copies of “Dedication: The Huawei Philosophy of Human Resource Management” stand on display at Huawei’s headquarters in Shenzhen.

cord high of 38% in the quarter ending in June 2019, according to Canalys.

Beijing moved a licensing round for fifth-generation networks forward to June, accelerating the rollout of the technology to give a boost to Huawei, which will provide much of the infrastructure for the new networks. And the Chinese government is set to unveil its own blacklist, seen as a warning to international companies not to cut off supplies to Huawei.

American logistics company FedEx is in Beijing’s sights, after being accused of sending packages of Huawei equipment to the wrong destinations, and of holding onto more than 100 parcels of Huawei-related shipments, rather than shipping them to China.

Ren himself has said that he would rather the government not back down in the trade war, even if Huawei is held hostage. In any case, Beijing is unlikely to see the company as a bargaining chip. Market watchers and tech industry executives said that Huawei’s success underpins China’s ambition to become a technology superpower; it is too big to fail.

“It’s the most successful Chinese tech company by revenue, by technology and by execution. It’s the national pride,” said Jonah Cheng, chief investment officer at J&J Investment, and a former UBS tech analyst. “For most Chinese people, hitting Huawei is an attempt by the U.S. to destroy the whole of China. ... China is unlikely to give in and allow Huawei to fall.” **N**

Nikkei staff writer Yifan Yu in Palo Alto, U.S., contributed to this report.

38%
Huawei share of
China’s smartphone
market in the quarter
ended June --
a record high

Source: Canalys

Illustration by Eric Chow



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Why Indonesia and India are hungry to host the 2032 Olympics

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SCHOOL'S OUT

Chinese students become pawns in America's trade war



U.S.: US\$6 / Japan: ¥600 (including tax) / Euro: EUR6 / U.K.: £4 / Australia: A\$8 / Bangladesh: TK480 / Brunei: B\$9 / Cambodia: US\$6 / Canada: C\$9 / China: RMB50 / Hong Kong: HK\$50 / India: Rs200 / Indonesia: Rp72000 / Korea: ₩7500 / Macau: HK\$50 / Malaysia: RM20 / Mongolia: US\$6 / Myanmar: US\$6 / Nepal: NR470 / New Zealand: NZ\$9 / Pakistan: Rs600 / Philippines: P280 / Singapore: S\$9 / Sri Lanka: Rs800 / Switzerland: CHF10 / Taiwan: NT\$200 / Thailand: B210 / Turkey: TL16 / UAE: AED27 / Vietnam: US\$6
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HOSTILE WELCOME

Chinese students have helped to transform U.S. universities into a \$39 billion export industry; now both Washington and Beijing are threatening to use them as bargaining chips in their escalating trade war.

YIFAN YU and COCO LIU Nikkei staff writers

Graduates of Columbia University's School of International and Public Affairs wave flags during the 2018 commencement ceremony.

PALO ALTO, U.S./HONG KONG Driven by a desire to experience college life in America, 19-year-old Vivian recently took a train for four hours from central China to the southern city of Guangzhou, the nearest place where she could take a visa interview at a U.S. consulate. Her plan hit turbulence the moment she arrived.

"What is your major?" Vivian recalled the visa officer asking her. "The next thing was that I would have to go through a background check."

A student at a university in Wuhan, who asked to be identified only by her English name, Vivian had won a place at summer school at the University of California, Berkeley, one of the world's leading engineering schools. But being a Chinese student majoring in a subject as sensitive as aerospace engineering opened her up to scrutiny.

"Chinese graduate students in my major are often subjected to additional screenings, but this is the first time I heard any-

A graduation ceremony at Fudan University in Shanghai in 2017: The Chinese government has warned prospective students of the trials and disadvantages of studying in the U.S.

one taking summer school [being] required to go through such a process," she said. "I was not even applying to study aerospace [engineering] in the U.S.; I just wanted to take a two-month computer course."

It took a month of waiting and a letter of guarantee from the university that she would not be allowed to enter any laboratories before the consulate finally granted her a visa. She was one of the lucky ones; one of her schoolmates, who planned to study automation, was turned down.

More than 360,000 Chinese students enrolled at American colleges in the 2017-18 academic year -- up from just 100,000 a decade ago. These students, and the universities that host them, now find themselves in the crossfire of the U.S.'s trade war with China. Since last year, Washington has tightened visa rules and intensified scrutiny on research collaborations between the two countries. At the same time, allegations of spying and intellectual property theft leveled by the administration against Chinese students and researchers have contributed to a hostile environment that threatens to undo years of progress.

"The U.S.'s tighter visa controls have sent a signal to Chinese students that we

"The U.S.'s tighter visa controls have sent a signal to Chinese students that we are not welcomed here. It makes me feel bad, as if someone shut the door in my face"

Lavender Jiang

A 20-year-old Chinese student of electrical engineering at Carnegie Mellon University

are not welcomed here," said Lavender Jiang, a 19-year-old Chinese who studies electrical engineering at Carnegie Mellon University in Pittsburgh. "It makes me feel bad, as if someone shut the door in my face."

LUCRATIVE TRADE Chinese parents are famous for their obsession with education, but the country's growing affluence over the past two decades has given many families the means to send their children overseas for further study. A 2015 study by Hurun Report, which publishes an annual rich list of China's moneyed classes, found



U.S.-China rivalry has intensified since U.S. President Donald Trump's first, and only, state visit to Beijing in 2017.

that millionaires in the country were willing to invest up to a quarter of their annual spending into their children's education. In 2017, more than 600,000 Chinese students left the country for tertiary education, the majority to study business, engineering, mathematics and science.

Universities from across the globe have rushed to capture a slice of this enormous export market, spending big on educational expos, marketing campaigns and partnerships with their Chinese counterparts.

Undergraduate degrees in the U.S. cost on average \$37,000 for international students at public colleges in fees alone, rising to more than \$48,000 for private universities -- among the highest in the world -- but the country has remained the most

popular destination for Chinese students due to the enduring cachet of an American education.

The U.S. has a product that Chinese students are desperate to buy; China has a huge supply of students willing to spend. However, geopolitics is now getting in the way, as the Trump administration intensifies its restrictions on Chinese businesses and citizens as part of its broader trade war.

In 2018, the U.S. shortened the duration of visas for Chinese graduate students in aviation, robotics and advanced manufacturing from five years to one year, citing the risk of espionage and theft of intellectual property. American intelligence agencies have reportedly warned universities about the risk of spying by students and

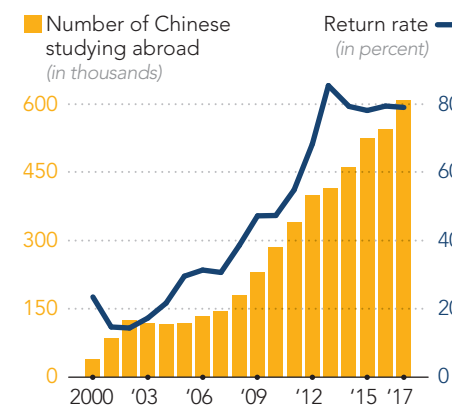
researchers, and urged that academics and university administrators receive training in how to identify potential threats. The crackdowns are part of a larger pattern of pressure on the exports of U.S. technology and intellectual property to China -- in May 2019, the Trump administration announced strict new restrictions on software and component sales to Huawei Technologies.

There are fears within the U.S. education industry that China may retaliate by cutting off the supply of students. Beijing has done this elsewhere in the past. In May 2017, the Chinese government reacted to a deterioration in relations with Taipei by halving the number of permits it issues to mainland students to study in Taiwan.

China has no control over the number of student visas issued by the U.S., making it harder to directly restrict the number of students heading there to study. However, Beijing does use propaganda to portray the U.S. as an unwelcoming hostile state and to diminish the benefits of studying abroad.

In May, the Global Times, the Chinese state newspaper owned by the Chinese Communist Party's mouthpiece the People's Daily, published an op-ed titled "Studying in the U.S. is a good option but is not the only option" which detailed the disadvantages of studying in the U.S. and

Chinese students abroad quadruple in a decade



Source: China Statistical Yearbook 2018

Fraying academic ties Recent U.S. moves to limit research links to China

June 2018
U.S. State Department cuts visa length from five years to one for Chinese students of aviation, robotics and advanced manufacturing; media reports the administration weighed an outright ban on Chinese students

April 2019
Spending bill forbids institutions hosting a Confucius Institute* from also accepting Defense Department funding for Chinese language classes; at least four Confucius Institutes at U.S. universities have closed since, citing the measure

*Network of Chinese government-backed language and culture centers **Recruitment program aiming to draw research talent to China
Source: National Association of Scholars, official releases, media reports

May
Emory University academics, husband-and-wife duo Li Xiaojiang and Li Shihua, fired for allegedly failing to disclose professional ties to China; follows similar dismissals at MD Anderson Cancer Center in April

May
Institute of Electrical and Electronics Engineers bans researchers "interacting with" Huawei Technologies from its peer review process; reverses decision days later

June
U.S. Department of Energy bans its researchers from China's "Thousand Talents"*** program

called U.S. universities “too arrogant.”

In June 2019, China’s Ministry of Education issued a warning to students hoping to study in the U.S. that they may face difficulties and delays in obtaining visas, saying: “The Ministry of Education reminds students and scholars to strengthen risk assessment before going abroad to study, enhance awareness of prevention and make appropriate preparations.”

“This warning is a response to recent series of discriminatory measures the U.S. took against Chinese students and can also be seen as a response to the U.S.-initiated trade war,” Hu Xijin, the editor of the Global Times, wrote on his Twitter account.

The U.S. does not disclose statistics on the number of visas applications that it rejects. However, applications are already declining in anticipation of future restrictions.

A report from education trade group NAFSA, released in May, showed that new international student enrollment in the U.S. is down 6.6% in the current academic year. “These decreases are in part due to several troubling federal policy changes that have altered the perception of the United States as a welcoming destination for international students, scholars, and researchers,” the report said.

U.S. universities have tried to distance themselves from the administration’s hostility. Some, including the University of California, Berkeley, Yale University and New York University, have sent open letters to students offering support and assistance. Even so, the atmosphere adds a new level of anxiety for students and researchers.

“I don’t feel any less welcome at Berkeley, and I think most American universities are quite liberal and need international collaborations to further their [research],” said David Wu, an economics Ph.D. can-

13.5%

SHARE OF CHINESE
GOVERNMENT-FUNDED
STUDENTS DENIED A VISA
TO THE U.S., JAN.-MAR. 2019

VS.
3.2%

DENIED IN 2018

Source: State Council Information Office of China

didate specializing in labor market study, who said that he has started to factor the U.S. government’s suspicions into his travel plans.

“I still have some reservations when I choose which country to visit when I go abroad,” he added. “I’m worried that visiting some communism-linked areas might make me look suspicious or [lead me to] become a potential spy suspect, which could cause trouble at border control when I reenter the U.S.”

With both sides in the trade dispute apparently willing to use students as leverage in their negotiations, American universities are very exposed.

International students generate \$39 billion in annual revenues for the U.S. ed-

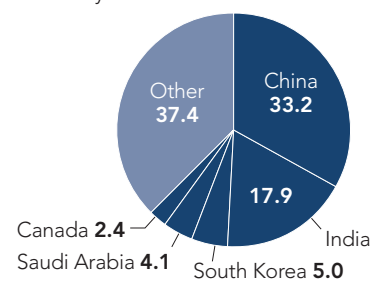
“**Why bother traveling all the way to the U.S. just to contribute to their GDP without getting any work experience back?**”

Lindsey Qian

A marketer in a gaming company in Beijing

Where the U.S.’s international students come from (in percent)

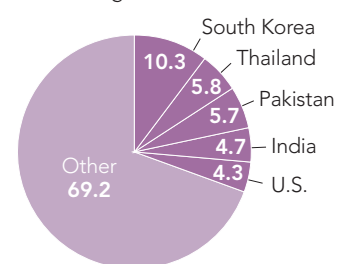
Top countries of origin for the 2017/18 academic year



Source: Institute of International Education

Where China’s international students come from (in percent)

Top countries of origin in 2018



Hong Kong, Macao and Taiwan not included
Source: Chinese Ministry of Education



David Wu, a Ph.D. candidate in economics at UC Berkeley, is worried that traveling to communist countries could “make [him] look suspicious.”

◀

but there is fear that it may change,” said David Lewis, an education counsel who specializes in bringing Chinese students to study computer science and law abroad. “That has discouraged people from applying to the U.S. Instead, they have been rethinking their options. ... They want to keep other countries in play.”

The U.K. is already picking up some of the slack. Lewis said 95% of his students applied for both American and British uni-

versities last year, up from just 30% when he first included access to the U.K. in his coaching service in 2016.

Canadian universities are also likely to benefit. America’s northern neighbor has set out its stall as an open and welcoming environment for international students, with exped-

ited visa processing for some applicants.

Perhaps more significantly, Canada offers three-year post-study work visas, and has made it easier for international students to immigrate -- in contrast to the U.S., where the Trump administration has sought to reduce the number of “H-1B” work visas by increasing the amount of evidence it requires from applicants in order to prove their qualifications, and by suspending a “premium processing” channel, which allowed fast-track applications for a \$1,500 fee. That has created a backlog in processing H-1B visas that has deterred companies from hiring international students.

Closing off the possibility of working in the U.S. after graduation is a major disincentive for Chinese students, reducing the potential return on their sizable investment in fees and costs.

Lindsey Qian is a marketer in a gaming company in Beijing. In 2018, she applied to half a dozen digital marketing master’s

sity due to an unpredictable event, such as a visa crackdown or a pandemic. Two years later, the business school and UIUC’s engineering college co-signed a three-year contract with the insurance broker Lloyd’s of London. Under the deal, the schools pay \$424,000 for cover worth \$60 million, triggered in the event of a 20% drop in revenue from Chinese students in a single academic year.

“The insurance is not because of Trump, but his administration definitely makes having such insurance an even better idea,” Brown said.

The insurance has yet to be triggered, and enrollment is actually slightly up for the coming academic year, but the schools

will be renewing their joint policy.

“We have not yet started renegotiating the new rate with the insurance company, but it concerns me that with the 2020 election coming up and the uncertainties that come with it, we might not get as good a deal as [we did] three years ago,” Brown said.

RIISING COMPETITION With the threat of new restrictions looming, some students are reconsidering their plans.

“Nothing has really changed [in policy]

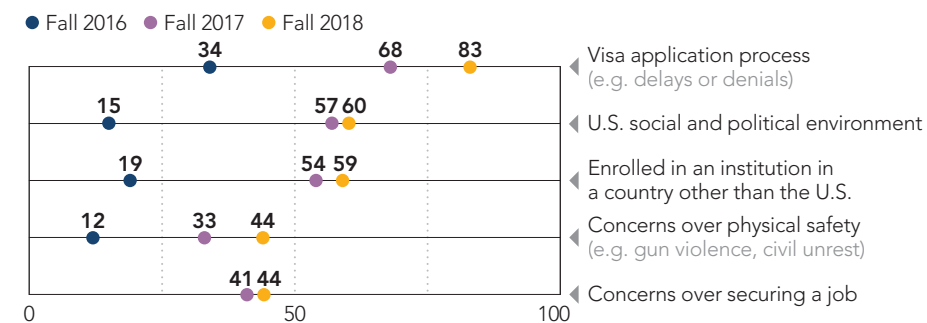
UP TO 25%
OF ANNUAL SPENDING

AMOUNT CHINA’S MILLIONAIRES
ARE WILLING TO INVEST INTO
THEIR CHILDREN’S EDUCATION

Source: Hurun Report, 2015

Why international students are shying away from the U.S.

Key reasons institutions cite for declining international enrollment (in percent)



Source: Institute of International Education

programs in the U.S., and received offers from several prominent schools, including Columbia University and the University of Maryland, for a place in the fall 2019 class. Qian declined all the offers and decided to reapply for the 2020 intake to colleges in Singapore and Hong Kong.

“For me, getting a master’s degree in the U.S. is mostly because I want to use it as a steppingstone in my career,” Qian said. “But recent news on the deteriorating China-U.S. relationship and the tightening H-1B policy makes me wonder if I can find a job in the U.S. after I graduate.”

A master’s degree in the U.S. would have cost more than half a million yuan (over \$72,000), Qian said, and the leg up it may or may not have given her in the competitive jobs market in China does not justify the expense. MBA programs

“**Right now, most of it is just rhetoric. ... [But] rhetoric could become the reality**”

Rachel Banks
Director of public policy at NAFSA

Cram school: U.S. universities are “stocking up for winter” by accepting large numbers of Chinese students this year, says one consultant.



in Singapore and Hong Kong cost half as much.

“Since my career plan is working in Asia anyway, why bother traveling all the way to the U.S. just to contribute to their [gross domestic product] without getting any work experience back?” Qian said.

ALL EYES ON 2020 The U.S. government’s threats to restrict Chinese students’ access to American education have run ahead of actual changes to policies. However, if Donald Trump wins reelection next year, analysts worry that his administration could double down on its anti-immigration agenda.

“Right now, most of it is just rhetoric,” said Rachel Banks, director of public policy at NAFSA. That alone is damaging, she said, but warned that “rhetoric could become the reality. [That] depends on which policy direction the country will take, which is going to be decided by the upcoming election.”

Anecdotally, universities seem to be preparing by enrolling as many students as possible in advance of any new restrictions.

“For fall 2019, I think my students have received even more offers from U.S. univer-

sities than in previous years, and other overseas study consultants also saw the same trend this year,” said Haichao Wu, founder and CEO of Kaiyin Group, an education consulting company that helps roughly 500 Chinese high school students prepare U.S. college applications every year. “I think American universities, especially the public ones, are stocking up for winter. They are admitting as many Chinese students as they can this year, because they might not be able to do so next year if Trump gets reelected.”

Even with the election still more than a year away, the result is already the subject of intense interest in China. “Chinese parents are becoming U.S. politics experts now as they closely watch the 2020 election and try to evaluate how it will affect their kids,” Wu said.

Yue Gao, a 49-year-old English teacher in Shanghai, has a son studying in California and a daughter at school in China. The U.S. presidential election is already a popular topic among parents in her daughter’s class, who share news and updates on their WeChat group. “I wasn’t interested in the news before,” Yue said. “But now I tune into [international news channel] CCTV-4 almost every day.”

